

## DESCRIPTION

Students will review aerobic composting, vermicomposting, and bokashi with a focus on key concepts such as organic matter, the nutrient cycle, decomposition, and decomposers. Students will be introduced to their culminating Team Poster Project. Students will use prior knowledge and skills gained throughout the year to design a poster about aerobic composting, vermicomposting, or bokashi composting.

**TIME:** 60 minutes

**SUBJECTS:** Science, Visual Arts, Language Arts

## LEARNING OBJECTIVES

After this lesson students will be able to:

- Compare and contrast, and discuss key elements, functions, and ingredients of each of the three composting systems.
- Design a aerobic composting, vermicomposting, or bokashi composting poster.

## ACADEMIC STANDARDS\*

**CCSS, Language Arts:** 3.RF.3, 3.W.1, 3.W.2, 3.W.10, 3.SL.1 **NGSS:** 3-LS4-3., 3-5-ETS1-2., LS4.C., ETS1.B., Systems and Systems Models, Influence of Science, Engineering and Technology on Society and the Natural World, Patterns, Systems and System Models **Lesson Extensions:** 3.W.1, 3.W.7, Obtaining, Evaluating, and Communicating Information

\*A detailed list of the Academic Standards can be found in the Unit Overview document.

## LESSON OUTLINE

- I. Introduction (25 minutes)
  1. Compost Systems Review Game
  2. Group Activities Overview
- II. Group Activities (30 minutes)
  1. Team Poster Project Planning
- III. Closing (5 minutes)

## KEY TERMS AND CONCEPTS

**Aerobic** - Refers to the presence of air (oxygen)

**Anaerobic** - Refers to the absence of air (oxygen)

**Bacteria** - Unicellular organisms; widely distributed in soil, water, air, and on or in the tissues or plants and animals

**Beneficial Microorganisms** - Naturally-occurring plant and soil microorganisms that can be cultivated and applied to improve plant health and the recycling of soil nutrients

**Bokashi** - A Japanese term meaning “fermented organic matter;” a method of composting that uses beneficial microorganisms to ferment and accelerate the breakdown of organic matter

**Compost** - Decayed organic matter; used to improve soil texture and fertility

**Compost Pile** - A heap of vegetation and other organic matter that is decomposing to become compost

**Decomposers** - Organisms that break down dead or decaying material and carry out decomposition

**Fungi** - Plural of fungus; spore-producing organisms that feed on organic matter; includes molds, yeast, mushrooms, and toadstools

**Invertebrate** - An animal lacking a backbone, such as an insect (arthropod) or a worm (annelid)

**Mindful** - Conscious or aware of something, to focus attention on the present moment

**Organic Matter** - Material that is either living or that originated from life

**Nutrient Cycle** - The movement and exchange of organic and inorganic matter (e.g., minerals) back into the production of living matter

**Vermicomposting/Vermiculture** - A system that uses composting worms to convert organic matter into vermicompost/vermicast



# LESSON MATERIALS

**Lesson Supplies:**

- Nutrient Cycle Sign
- Garden Agreements Sign
- Large blank paper (3 per class)
- 24 Half sheets of paper (plus extra)
- 3 Compost Systems Map Signs (Aerobic Composting, Vermicomposting, and Bokashi)
- Compost Systems Map Question Cards
- Compost Map Answer Cards
- Student Workbook

**School to Provide:**

- Markers, crayons, coloring pencils

## ACCOMPANYING DOCUMENTS

- Student Worksheet: Compost Systems Review
- Student Worksheet: Composting Systems Comparison
- Student Worksheet: Team Poster Project

## ADVANCE PREPARATION

- Discuss lesson preparation and presentation plans with your teaching team.
- Make copies of the Compost Systems Review, Composting Systems Comparison Student and Team Poster Project Student Worksheets, one per student if not using the Student Workbook.
- Set up the Compost Systems Map Question Cards on the whiteboard according to the diagram in the pink box on the left. Students will post the correct Compost Map Answer Cards under the Question Card.
- Draw out the Composting Systems Comparison table on the whiteboard according to the diagram on page 4. Place the 3 Compost Systems Map Signs (Aerobic Composting, Vermicomposting, and Bokashi) in the first row of the Composting Systems Comparison table. Students will post the correct Compost Map Answer Cards in the table.

The diagram shows a whiteboard layout for lesson materials. At the top, a pink box contains the question: "1) What is compost?". Below it is an answer card for "LAW" (Lawn Mower, Automobile, Wax). The next question is "2) What does L.A.W stand for?". Below it is an answer card for "LAW" (Lawn Mower, Automobile, Wax). The third question is "3) Life is Organic Matter. What are some examples of Organic Matter?". Below it are three answer cards: "Food Waste (Garbage)", "Clear Wash/Dripnet", and "Thompson P.O.". The final question is "4) What does F.B.I. stand for?". Below it are three answer cards: "Fungus", "Bacteria", and "Insect Microbes". To the left of the whiteboard are stacks of "Compost Systems Map Answer Cards", "Compost Systems Map Question Cards", and "Compost Systems Map Signs" for Aerobic Composting, Vermicomposting, and Bokashi. Below the whiteboard is the "Compost Systems Review Game Key".

This block displays three student worksheets. The first is the "Composting Systems Comparison" worksheet, which includes a table with columns for "Aerobic Compost Pile", "Vermicomposting Worm Bin", and "Bokashi". The second is the "Compost Systems Review" worksheet, which contains multiple-choice questions about composting. The third is the "Team Poster Project Student Worksheet", which provides a grid for students to record information for their team poster.

## INTRODUCTION

25 MINUTES

### COMPOST SYSTEMS REVIEW GAME

“Aloha! Today is our seventh ‘ĀINA In Schools lesson on composting and our second to the last lesson of the school year. We will play a Compost Systems Review Game to review the three composting systems we have learned throughout the year.” Pass out the Compost Systems Review Student Worksheet (if not using the Student Workbook page 25).

“To start, what are the three different compost systems we learned about and created this year?”  
Desired answer: AEROBIC COMPOSTING, VERICOMPOSTING, and BOKASHI. Point to the Aerobic Composting, Vermicomposting, and Bokashi Compost Systems Signs up on the whiteboard. “For each compost system there are questions that we are going to answer as a class.” Point to the 4 Compost Systems Map Question Cards next to the Compost System Map Signs.

“Each of you will get 1-2 Compost Map Answer Cards. As we answer each question, if you have the correct Answer Card you may come up and place it under the question. Use your worksheet on page 25 to write the correct answers and draw pictures in the circles on your worksheet as we play the game.”

Pass out 1-2 Answer Cards to each student. If students are sitting in groups have the students work together to find the correct Answer Card. As the students play the review game guide them through the Student Worksheet on where to write the correct answers and draw pictures.

### DOCENT TIP

After each question, have the student with the correct card post their card under the question on the whiteboard with a magnet or tape. Sometimes there might be multiple correct cards for each answer, so choose only one student of the same card to come up to the whiteboard.

### COMPOST, L.A.W., AND SOIL F.B.I. REVIEW

“This year we have learned why composting is important. **Question #1 What is Compost?**” Desired answer: COMPOST is decayed organic matter that is used to improve soil texture and fertility. “Composting reduces waste and recycles nutrients to nourish our garden soil and plants.” Have the student with the compost Answer Card post the card on the board.



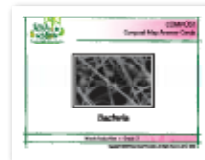
“There is a L.A.W. that decomposition of organic matter follows. **Question #2 What does the L.A.W. stand for?**” Desired answers: Life/ORGANIC MATTER, air, and water. “Correct! For decomposition to occur there must be life, air, and water present.” Have the student with the L.A.W. Answer Card post the cards on the board.



“Life is organic matter. **Question #3 What are some examples of organic matter?**” Desired answers: Brown waste/carbon (dried leaves, sticks, branches, shredded paper), green waste/nitrogen (green leaves, grass clippings, food waste, etc.), DECOMPOSERS (F.B.I.). Have the students with the brown waste (carbon), green waste (nitrogen), and decomposers (F.B.I.) Answer Cards post the cards on the board.



**Question #4 “What does the F.B.I. stand for?”**  
Desired Answers: FUNGI, BACTERIA, AND INVERTEBRATES. Have the students with the fungi, bacteria, and invertebrates Answer Cards post the cards on the board.



**COMPOSTING SYSTEMS COMPARISON KEY**

	 <p><b>AEROBIC COMPOSTING</b></p>	 <p><b>VERMICOMPOSTING</b></p>	 <p><b>BOKASHI</b></p>
<p><b>1. What types life/organic matter are OK to be added in the compost system?</b></p>	  <p><b>9, 10, 11, 12</b></p>	  <p><b>20, 21, 22, 23</b></p>	   <p><b>35, 36, 37, 38, 39, 40, 41</b></p>
<p><b>2. What types of decomposers (F.B.I.) are found in the compost system?</b></p>	 <p><b>13</b></p>	  <p><b>24, 25</b></p>	 <p><b>42</b></p>
<p><b>3. Does the compost system require air?</b></p>	 <p><b>14</b></p>	 <p><b>26</b></p>	 <p><b>43</b></p>
<p><b>4. Does the compost system require water?</b></p>	 <p><b>15</b></p>	 <p><b>27</b></p>	 <p><b>44</b></p>
<p><b>5. What types of waste stays out of the compost system?</b></p>	  <p><b>16, 17, 18, 19</b></p>	       <p><b>28, 29, 30, 31, 32, 33, 34</b></p>	  <p><b>45, 46</b></p>
<p><b>6. How long does it take until finished compost is produced?</b></p>	<p>4-5 months</p>	<p>2-3 months</p>	<p>1 month</p>

## INTRODUCTION

CONTINUED

“Now we are going to review the three types of composting systems we studied this year: Aerobic composting, vermicomposting, and bokashi. Please turn to the Compost Systems Comparison Worksheet on page 26 in your Student Workbook. In each box you can either write or draw in the correct answers.

### AEROBIC COMPOSTING REVIEW QUESTIONS

“**What types life/organic matter are OK to be added in the aerobic compost pile?**” Desired answers: Dried leaves, sticks, wood chips (browns/ carbon), green leaves, grass clippings, food scraps, etc.), water, and soil. Have the students with the dried leaves, sticks, wood chips (browns/ carbon), green leaves, grass clippings, food scraps (greens/ nitrogen), water, and soil Answer Cards post the cards on the board.



“The AEROBIC COMPOST PILE attracted living creatures to help break down the organic matter. **What types of decomposers (F.B.I.) are found in the aerobic compost pile?**”

Desired answer: DECOMPOSERS: FUNGI, BACTERIA, and INVERTEBRATES (F.B.I.). Have the student with the decomposers (F.B.I.) Answer Card post the card on the board. Remember that the F.B.I. work for the L.A.W. as they are part of the Life category and vital to the NUTRIENT CYCLE. Show the Nutrient Cycle Sign to remind students of the important role these organisms play in recycling nutrients for use by plants and animals, including people.



Nutrient Cycle Sign

Point to the Aerobic Composting System Sign on the board. “**This system is called an aerobic compost pile, what does aerobic mean?**” Desired answer: AEROBIC refers to the presence of air (oxygen) in the system. Have the student with the aerobic (presence of air) Answer Card post the card on the board.



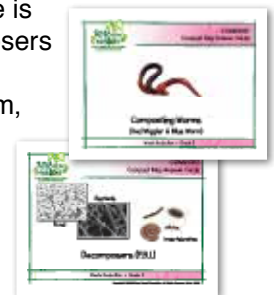
“**What types of waste stay out of the aerobic compost pile?**” Cooking oil, meat, bones, and processed foods, dairy, plastic, glass, glossy paper, and metal. Have the student with the correct Answer Cards post the card on the board.

### VERMICOMPOSTING REVIEW QUESTIONS

Move to the Vermicomposting Compost Systems Map Sign. In our worm bin we included similar kinds ORGANIC MATTER. “**What organic matter did we put in the vermicomposting system?**” Desired answers: Shredded paper, cardboard (browns/ carbon), fruit and vegetable scraps, egg shells, grains (greens/nitrogen), water, and a little bit of soil. Have the students with the shredded paper and cardboard (browns/ carbon), fruit and vegetable scraps, egg shells, and grains, (greens/nitrogen), and water Answer Cards post the cards on the board.



“**What special invertebrate is used in vermicomposting that is not found in aerobic composting?**” Desired answer: Composting worms (i.e. red wiggler, blue worm). There is also a presence of other decomposers (F.B.I.) in the worm bin. Have the students with the composting worm, and decomposers Answer Cards post the cards on the board. Ask students to share a few facts they know about composting worms.





**INTRODUCTION** **CONTINUED**

**“Is the worm bin an aerobic or Anaerobic environment?”** Desired answer: AEROBIC, meaning air is present in the system. Have the student with the aerobic (presence of air) Answer Card post the card on the board.



Have the students with the correct Answer Cards post the cards on the board. “Next lesson we will look at the similarities and differences of the three compost systems and complete the Compost Systems Map Student Worksheet.”

**“What types of waste stay out of the worm bin?”** Cooking oil, meat, bones, and processed foods, dairy, plastic, glass, glossy paper, and metal, garlic and onion, papaya seeds, and citrus fruit. Have the student with the correct Answer Cards post the card on the board.

**“What does ANAEROBIC mean?”** Desired answer: ANAEROBIC refers to the absence of air (oxygen in a the system. Have the student with the anaerobic Answer Card post the card on the board.



**BOKASHI REVIEW QUESTIONS**

Move to the Bokashi questions. “What is BOKASHI composting?” Desired answers: BOKASHI is an anaerobic method of composting that uses BENEFICIAL MICROORGANISMS to ferment and accelerate the breakdown of organic matter.

**“What types of waste stay out of the bokashi bucket?”** Desired answers: Cooking oil, plastic, glass, glossy paper, and metal. Have the student with the correct Answer Cards post the card on the board.

**“What ingredients did we use to make bokashi?”** Desired answers: wheatmill run, water, molasses, beneficial microorganisms in the form of effective microorganisms (EM®) or indigenous microorganisms (IMO) and lactic acid bacteria (LAB) cultivated on site. Have the students with the correct Answer Card post the cards on the board.

**GROUP ACTIVITIES OVERVIEW**

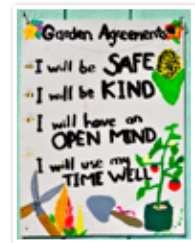
“Today our class will be split into three groups: Aerobic Composting, Vermicomposting, and Bokashi. You will work together as a group to create a poster about your composting system.”



**Garden Agreements**

Have students take a deep breath, then repeat and discuss the Garden Agreements as listed on the Garden Agreements Sign:

- I will be SAFE
- I will be KIND
- I will have an OPEN MIND
- I will use my TIME WELL



**“What foods can be added to the bokashi bucket?”** Desired answers: Fruit & Vegetable Scraps, Egg Shells, Grains, Meat, bones, and processed foods, and dairy.

“This year we have been practicing being MINDFUL, being conscious or aware of something and to focus attention on the present moment. How can we be mindful when we split into groups and work in teams?” Take a few answers.



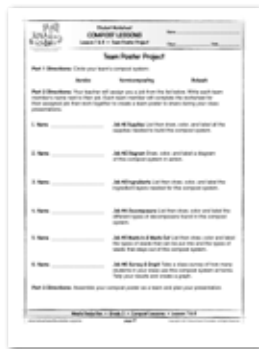
Divide class into three groups and assign each group a composting system: Aerobic Composting, Vermicomposting, and Bokashi. Students will remain in these groups for the Team Poster Project throughout lesson 7 and lesson 8. Have students bring their color pencils, crayons, or markers.

## GROUP ACTIVITIES

30 MINUTES

### TEAM POSTER PROJECT PLANNING

Have students sit in their three groups: Aerobic Composting, Vermicomposting, and Bokashi. Have students open their Student Workbooks to the Team Poster Project Student Worksheet on page 27 and read through the directions as a group.



Team Poster Project Student Worksheet

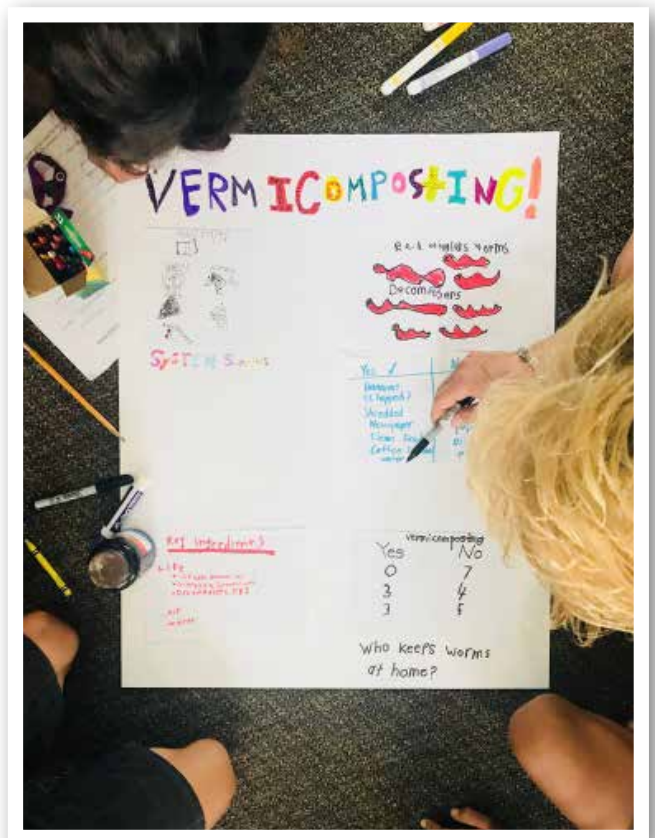
### GROUP TASKS

Support students in completing the following tasks listed on their Student Worksheet:

1. Circle your team's compost system.
2. Your teacher will assign you a job from the list. If there are more than 6 students in a group, assign two students to a job. Write each team member's name next to their job. Each team member will complete the worksheet for their assigned job then work together to create a team poster to share during your class presentations.
3. Assemble your compost poster as a team and plan your presentation.

### DOCENT TIP

One docent should be assigned to each student group to provide support and help with their poster and presentation. Support students through completing their job on the worksheet and half sheet of paper. Ensure they feel comfortable and prepared for their presentation.



## CLOSING

5 MINUTES

Gather all the students in the garden/compost area.  
Ask them to share about their experience.

Discuss with students:

- What did all compost systems have in common?
- How did they differ?
- How did you practice being MINDFUL today in your group?
- What tasks did you complete? What tasks remain to be ready for your presentations?



## FOLLOW UP COMPOST CARE

**Follow Up Compost Care is the responsibility of the classroom teacher and students.**

- Continue to have students care for the aerobic compost pile(s) and worm bin(s) as described in the Follow Up sections of Lessons 5 and 6.



## FOLLOW UP ACTIVITIES

**Follow Up Activities are the responsibility of the classroom teacher.**

- Have students continue to work on their Team Poster Project and presentations between lessons 7 and 8. The more time the better! Students will have 15 minutes during Lesson 8 to put finishing touches on their posters.
- Have students practice their presentations so that they are comfortable and confident speaking to their role in the group presentations.
- Have students keep a journal about the composting experience including notes, opinions, drawings, poems, stories, etc.





## LESSON EXTENSIONS

### Buried Treasure

(3.W.1, 3.W.7, Obtaining, Evaluating, and Communicating Information)

1. Give each student a small plastic net-like bag (e.g., onion bag) and have them fill it with any and all types of “waste” materials such as banana peels, apple cores, and pieces of plastic, paper, and metal. Have students create a journal entry describing the contents of their bag, and what they predict will happen after their bags have been buried in the soil, compost pile, worm bin, or garden for 1 month (or other designated amount of time).
2. Write each students’ name with a permanent marker on a piece of plastic (e.g., a poker chip) and have them put it in their bag. Seal the bags with twist ties or double knotting.
3. Alternatively, have the class create four bags according to the above instructions, and record the contents of the bags.
4. Bury the bags in four locations on campus: In the aerobic compost pile, the worm bin, the garden soil, and regular schoolyard soil. Be sure to mark the areas with signs stating the project name, classroom number, and date. Leave the bags buried for at least 1 month (or other designated amount of time).
5. Have students “excavate” the bags and study their contents, making detailed observations and notes about the changes (or lack of changes) and differences observed.
6. Have students write a mini science report about the experiment, including a question, hypothesis, experimental method, data, and conclusion.
7. Have students write opinion pieces about their thoughts on the meaning of the experiment’s results and the implications for the planet and their attitudes and behaviors about waste.

### Creative Compost Expression

(3.W.1, 3.W.7)

1. Explore creative ways for students to present their Compost Consultant Project such as making a video, song, poem, photo book, drawing or painting, etc.
2. Hold a talent show or student lead art exhibition for students to perform or showcase their creations.

